T-1018 Spacordion Tungsten Fiber Calorimeter at FTBF.

Oleg Tsai

(UCLA)

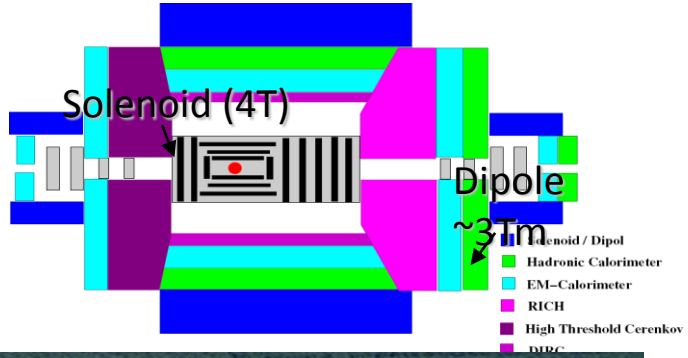
All Experimenters Meeting

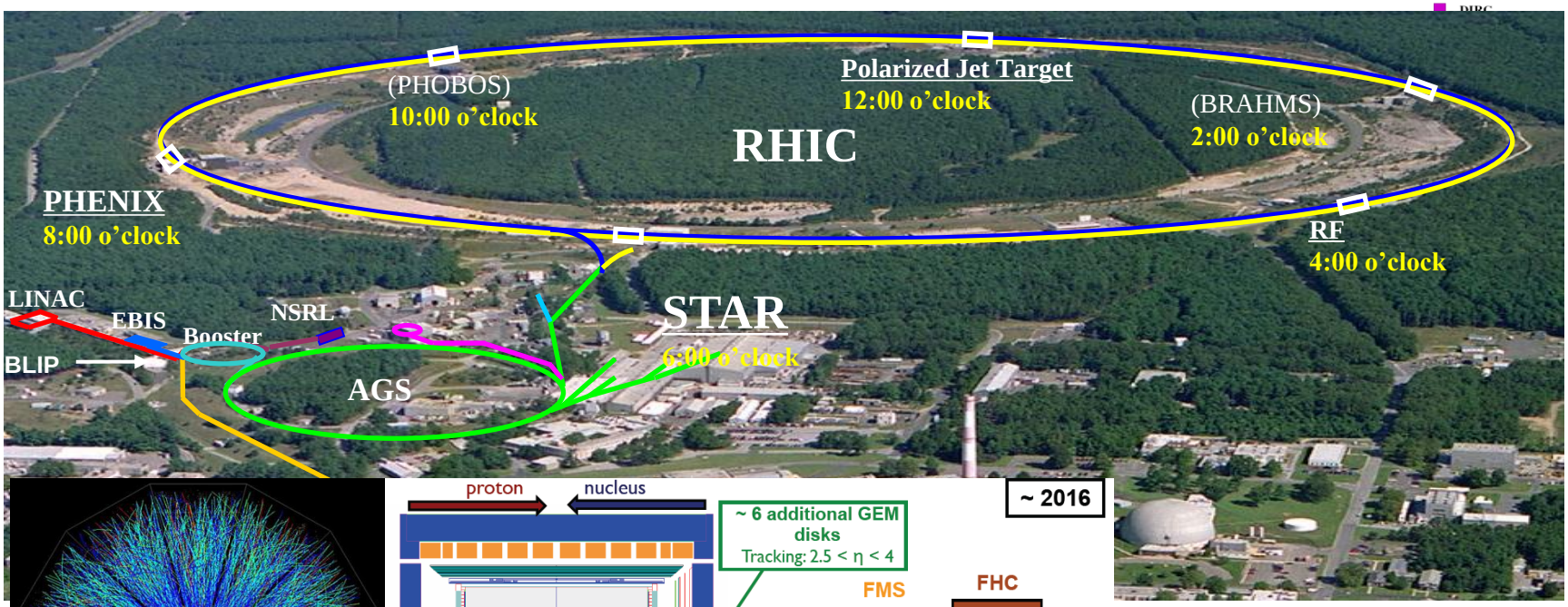
FNAL , Jan. 30, 2012

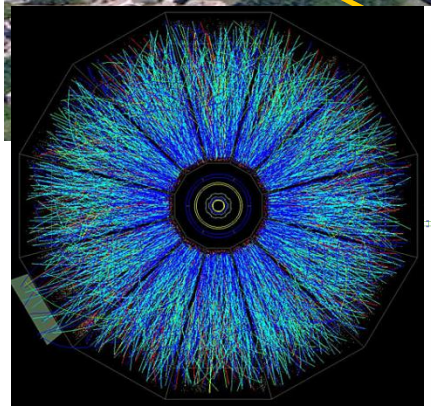
EIC Generic Detector R&D. BNL &JLAB

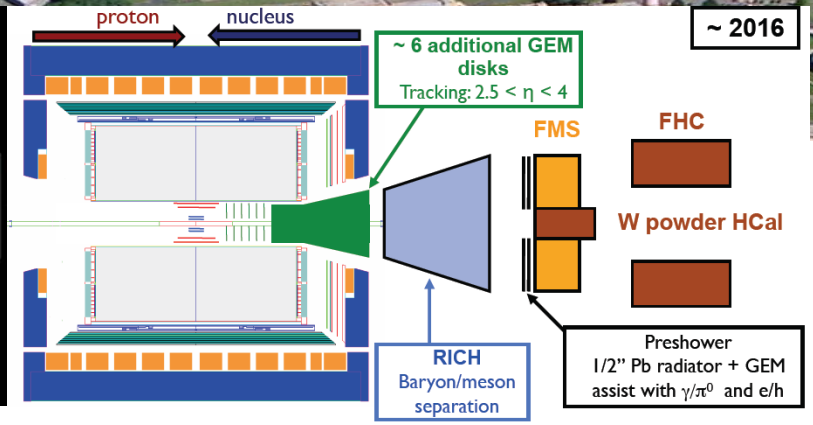
Development of a new detector technology for fiber sampling calorimeters for EIC and STAR.

(UCLA ,Texas A&M, Pennsylvania State University)









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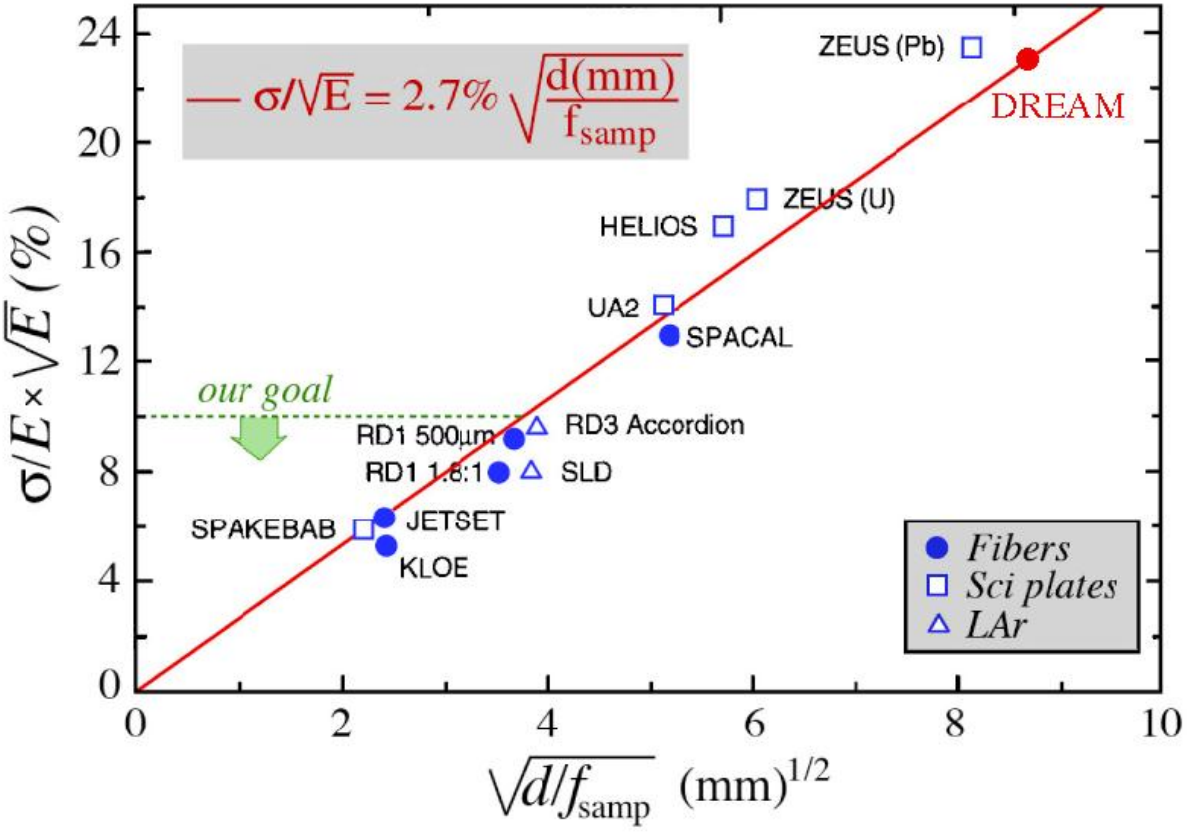
- ***Some common requirements for EMCs are:***
- ***Good energy resolution. Compact. Readout in magnetic fields. STAR specific – compensated, fine granularity EM .***

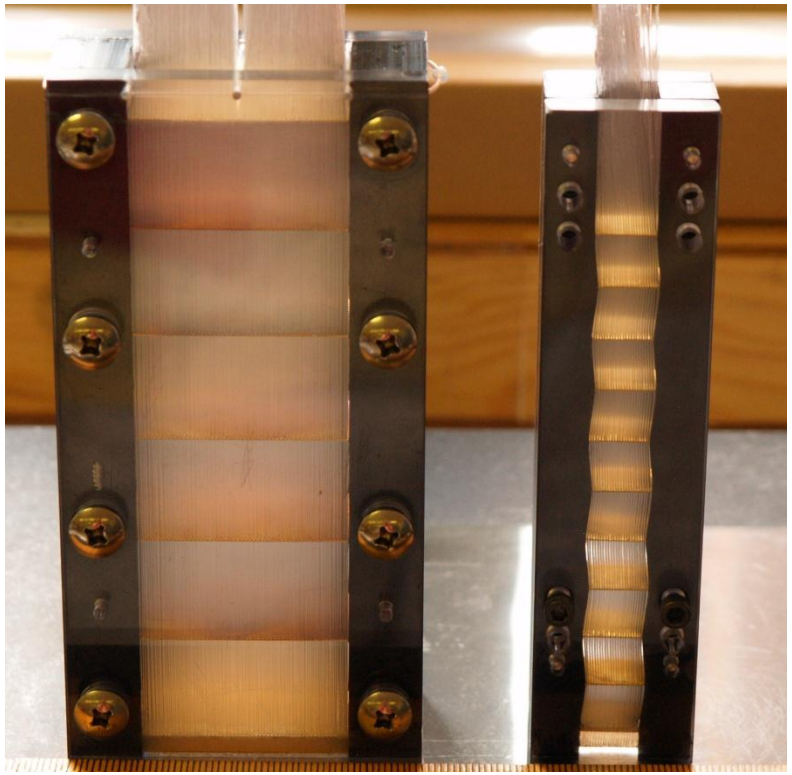


ScFi calorimeters have a good record.

We are developing a new, simple and cost effective method to build ScFi EMCs using W powder as an absorber material.

Technology:

1. ***Put fibers in set of screens.***
2. ***Spread meshes and put assemblies in container.***
3. ***Epoxy both ends (photodetector and mirror end)***
4. ***Fill container with W powder.***
5. ***Replace air in detector with epoxy.***



Very Simple !

AEM, Oleg Tsai (UCLA)

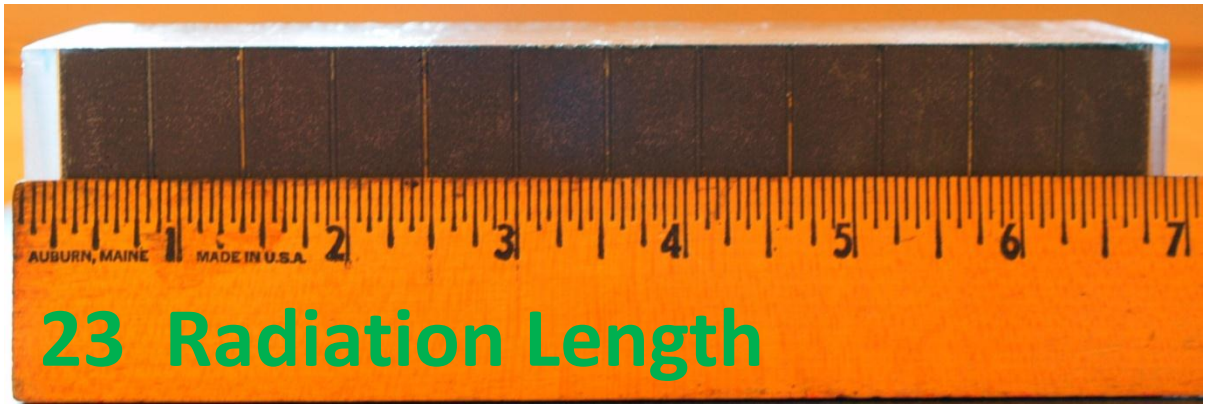
- ***Technology:***

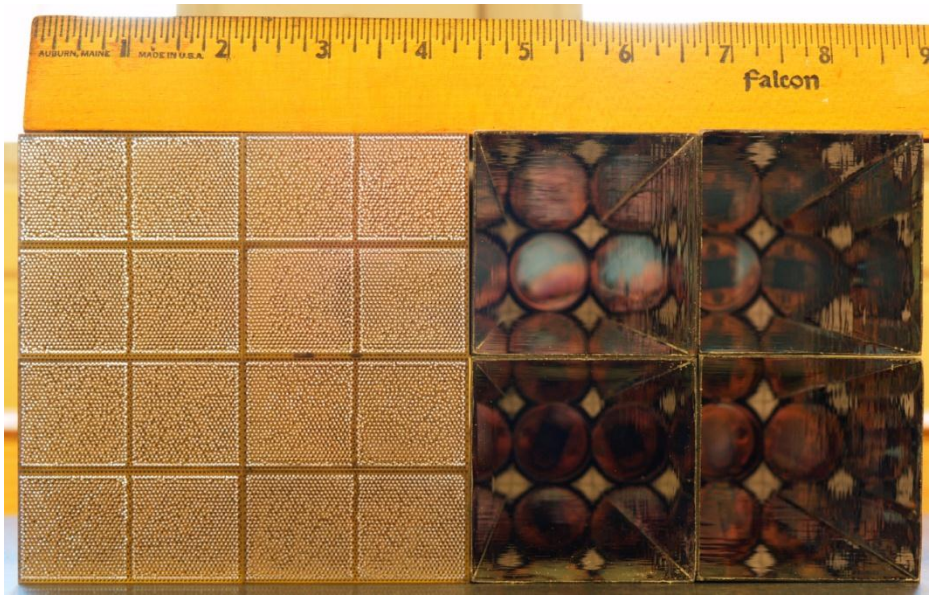
- ***Cost effective.*** ***Cost of W powder less than 1/3 of the cost of W plates (raw materials). Does not require additional processing.***
- ***Significant reduction of manual labor.*** ***Fibers processed hundreds at a time. (30 min to arrange ~1500 fibers in matrix)***
- ***Technique is simple. But !***

Requirements on tolerances and uniformity are tight! The denser the calorimeter the tougher these requirements are.

- ***SPACAL Supermodule Prototype Details.***

Compact: ***Final density 10.17 g/cm3, X0 ~ 7 mm, Rm ~ 2.3 cm***





Supermodule
2x2 towers.
Tower size 1" x 1"
Already provisional integration clearances for future compact readout.

T 1018 Light Collection Long Acrylic Light Guide ESR mirror pipe. Single PMT per supermodule

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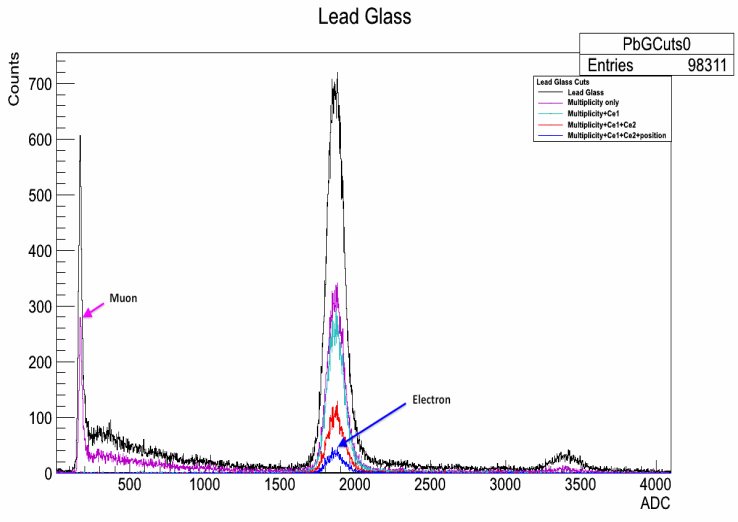
T1018 Setup


Lead Glass
(FTBF)
SPACAL
Spacordion
XY Sc/SiPMT
Hodoscopes
SOUTHWORTH
FRAGILE

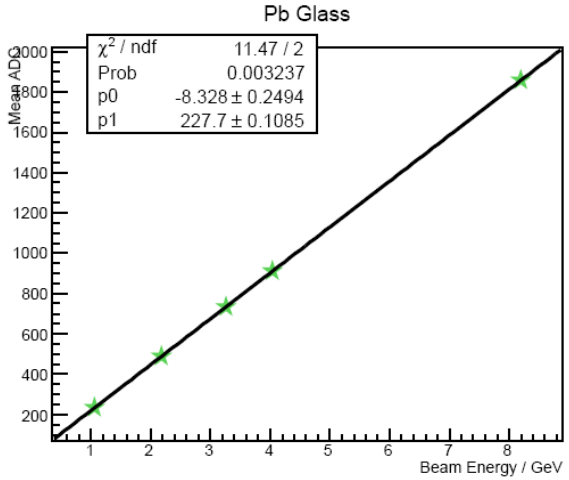
Beam On!

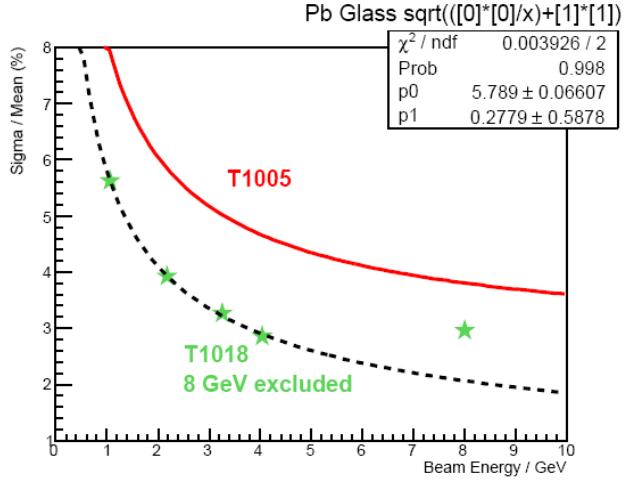


FTBF Lead Glass – very important standard good resolution calorimeter on the beam line.
That makes users happy.

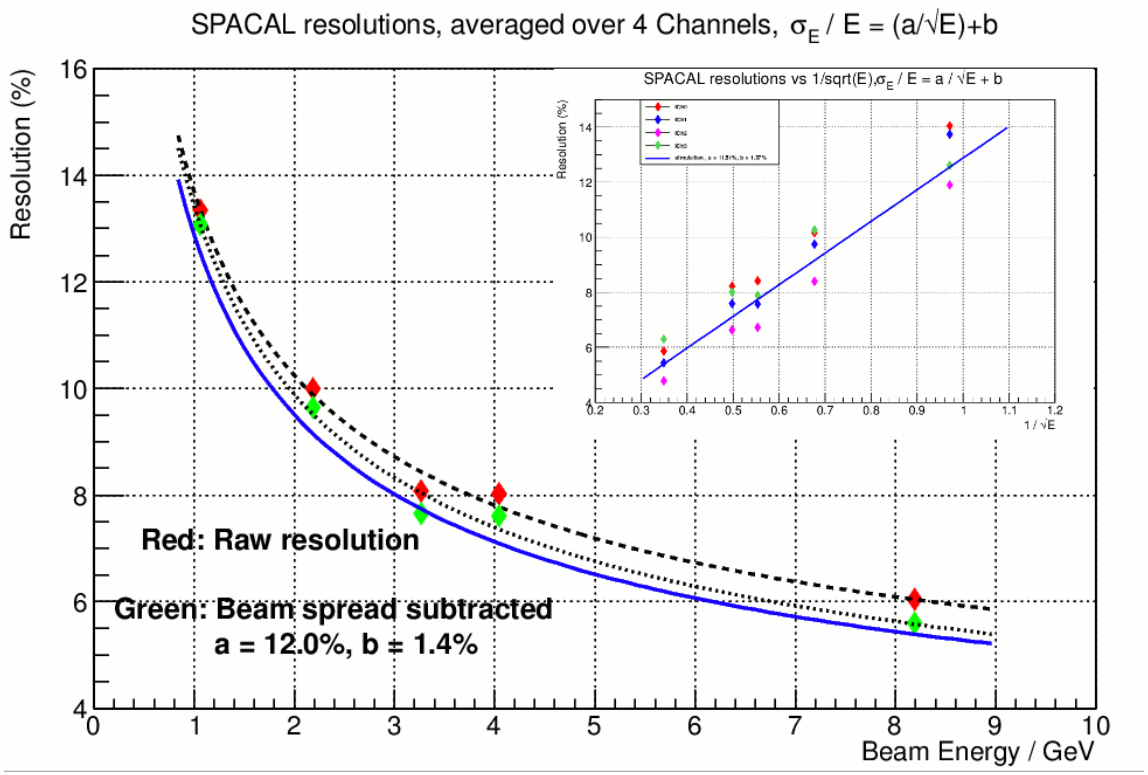
Thank you FTBF team for providing it for us!

With this calorimeter we set the absolute energy scale and estimated the momentum spread of the beam at 8 GeV to be 2.3%.
For range 1-4 GeV we used T1005 number - 2.7%





T1018 It works!



Also measured:

Uniformity of response across the towers.

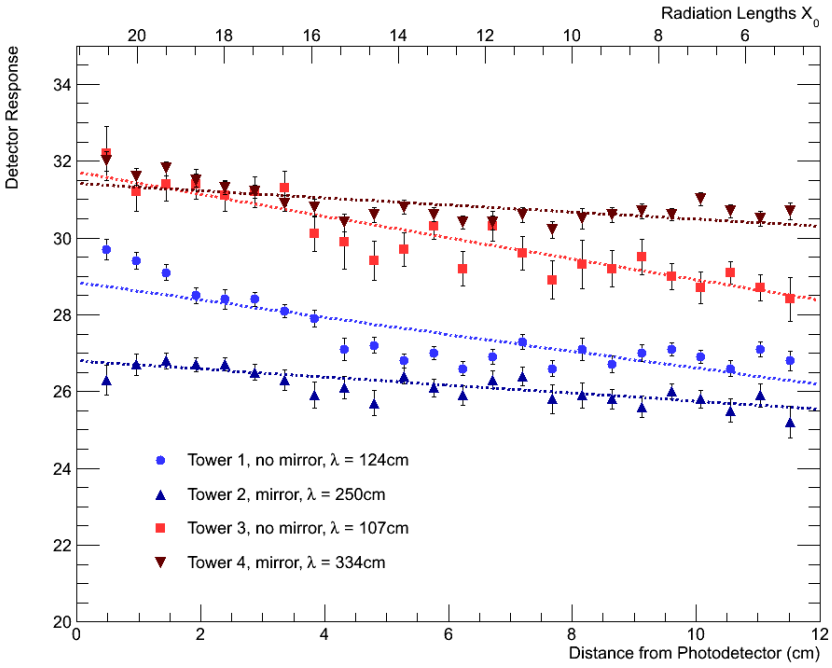
Energy resolution with and without mirror.

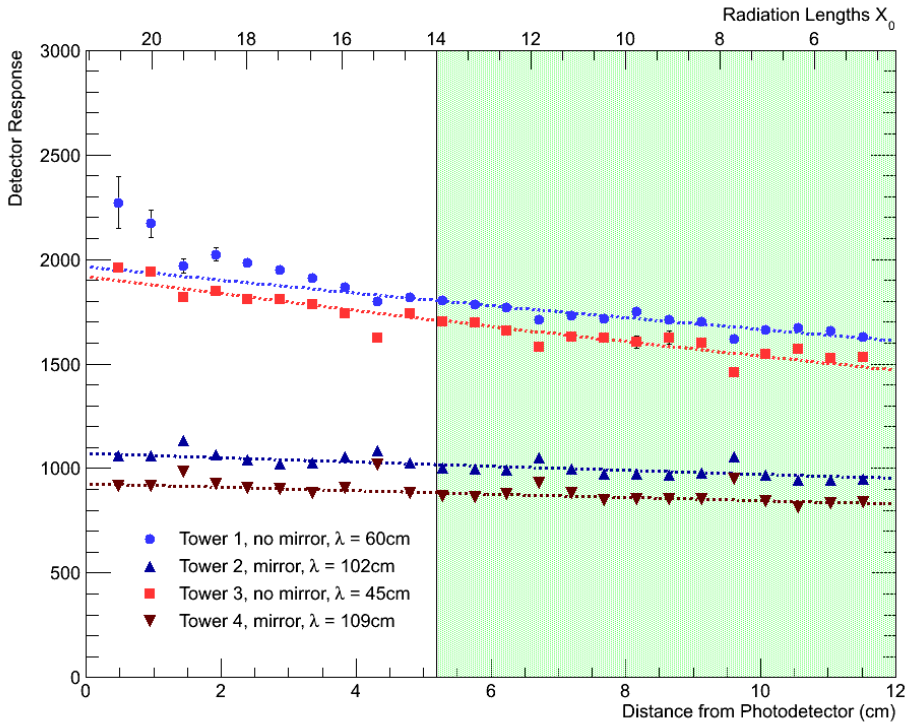
Perform scans along the towers with electrons and muons.

Estimated effects of attenuation and towers non-uniformities on resolution.

1. ***Resolution is close to expected.***
2. ***Light yield is very good ~ 4000 Phe/GeV***

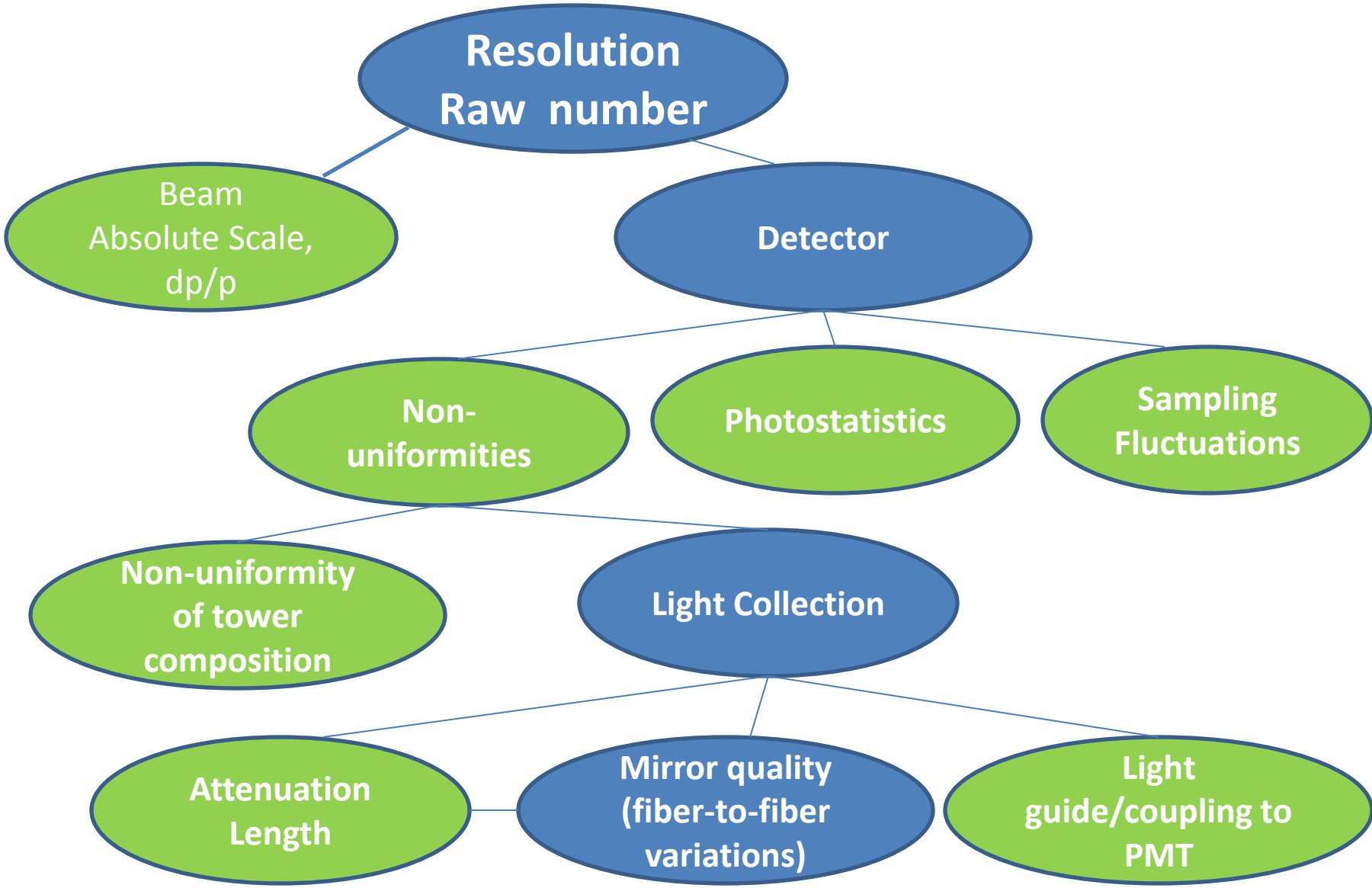
- ***T1018, some preliminary results.***
- ***Measured resolution with and without mirrors. (Attenuation length)***
- ***Do scans along the towers with muons and electrons. (Non-uniformities)***



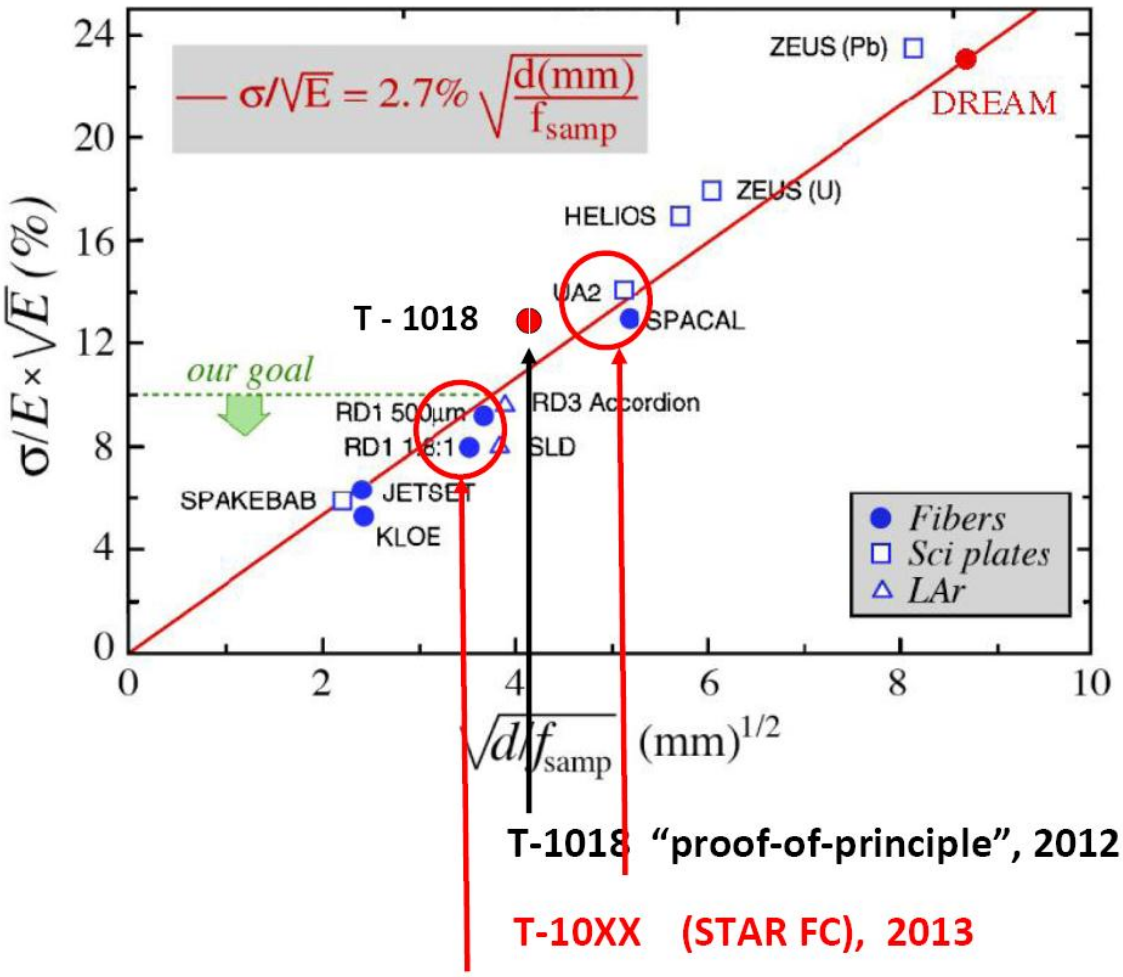


Typical attenuation length for 0.5 mm fibers (no damage due to packing). Non-uniformities inside the towers is ~ 5% in the most important region from 5-14 Xo.

- ***Some effects affecting resolution was estimated.***



Future plans: Let's keep filling this plot!



T1018

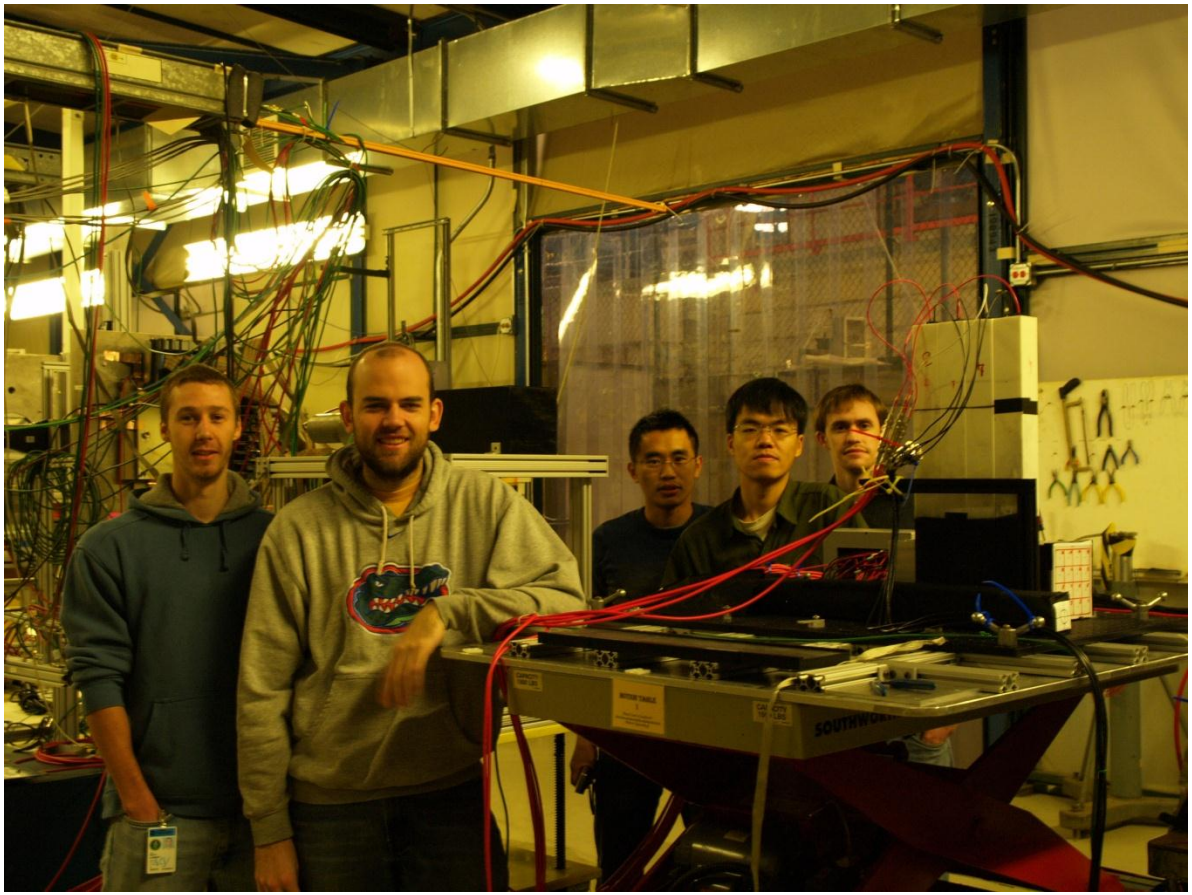
Jan.30, 2012

Very successful Run

Got "proof-of-principle"

Had fun time to get plenty of good data.

Five graduate students had their first own beam experiment!



Thank FTBF, FNAL, and MCR to make this test run possible !

L. Dunkelberger, H.Z. Huang, G. Igo, K. Landry, Y.Pan, S.Trentalange, O.Tsai, W. Xu (UCLA)

C. Gagliarddi (Texas A&M)

C.Dilks, S.Heppelman (Penn State)

Backup slides.

- # *R&D - Rapid Development in 2011.*

***R&D Proposal** was approved in mid May 2011.*

***SPACORDION** was build during July-August 2011.*

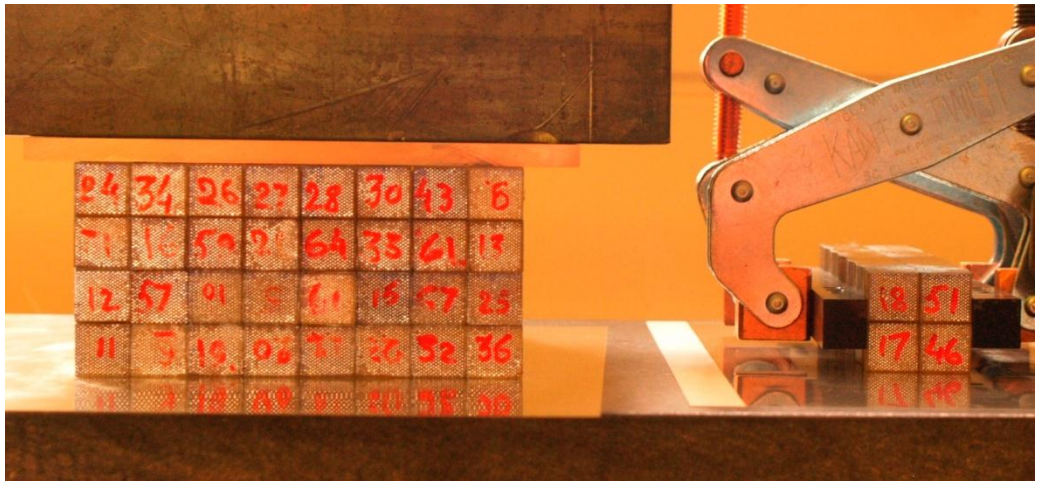
***MOU** for test run sent to FNAL at the end of summer 2011.*

***SPACAL EMC** constructed*

in 8 days in November 2011.

***Goal** for the first year of R&D Is to demonstrate this new method will work.*

"Proof-of-Principle".



AEM, Oleg Tsai (UCLA)

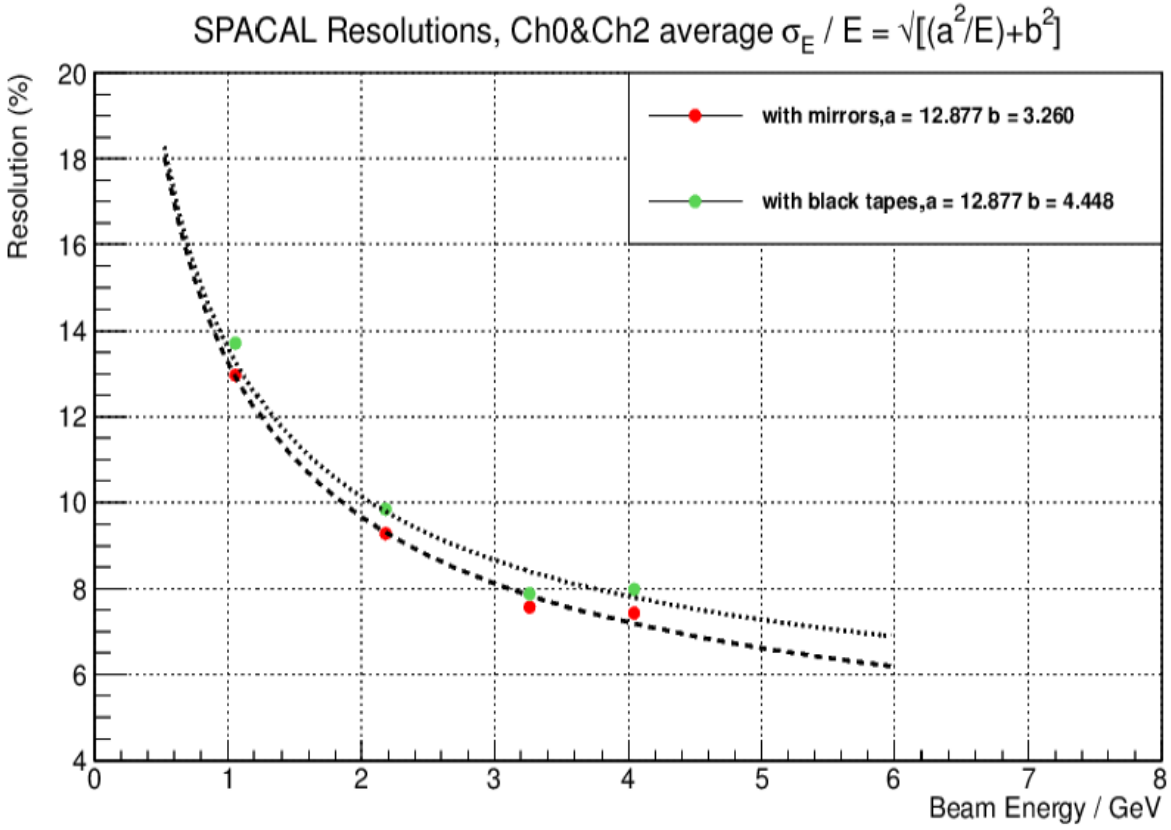


fig.4 ch0 and ch2 average resolutions